Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Revision of Part 15 of the Commission's	)	
Rules Regarding Ultra-Wideband	)	ET Docket No. 98-153
Transmission Systems	)	

Comments of M/A-COM

M/A-COM, a division of Tyco Electronics Corporation which is a unit of Tyco International,. submits these comments in response to the Notice of Proposed Rulemaking ("Notice"), FCC 00-163, released May 11, 2000 in the above-captioned proceeding.

Summary of Position

M/A-COM supports several of the proposals in this rulemaking because they provide more efficient use of spectrum and would permit the use of applications like our Automotive Object Detection Systems. Such devices will provide more safety and security to the driving public without harming the existing users of spectrum.

In particular, we support the proposed definition of ultra-wideband using a 10 dB bandwidth, except that a 20 dB bandwidth should be permissible if it can be measured. We support the proposed new limit on peak-to-average ratios, because it would provide manufacturers with more flexibility in trading off duty cycle against peak power levels without causing more interference. Finally, M/A-COM is investigating alternative measurement methods for use around 24 GHz, and we will describe our proposed measurement methods at the time our device is submitted for an equipment authorization.

M/A-COM's Interest In This Proceeding

M/A-COM is a world leader in the design and manufacture of RF, microwave and millimeter wave materials, devices, components, subsystems and systems. Our solutions (which include discrete semiconductors, ICs, multi-function assemblies, cables, connectors and antennas) are already hard at work in thousands of government and high volume commercial applications around the world, from cellular phones to wireless LANs, PCS base stations to advanced automotive electronics, and satellite systems to navigation systems. With decades of microwave experience and a heavy commitment to R&D, we are able to provide our partners with the solutions today's market demands. In 1995, M/A-COM merged with AMP, Inc. which in turn was acquired in 1999 by Tyco International.

M/A-COM's interest in this proceeding differs from that of most other participants, because our UWB products are in the millimeter wave range rather than below 10 GHz. Consequently, our views may differ from other comments without necessarily being in conflict.

As previously described in this proceeding, M/A-COM is developing a 24 GHz, high resolution radar sensor for use by automobile manufactures for Object Detection Systems on motor vehicles. The detection system assists drivers by providing more information, enabling safer driving, and by mitigation of accident severity in the case of a collision. The specific applications include Rear Object Detection in backing up, Side Object Detection for Blind Spot scenarios, Lane Change Aids, Advanced Autonomous Cruise Control (ACC) for Urban Driving conditions and Pre-impact Sensing for improving safety system response time. This high resolution radar, employing UWB techniques and occupying a 20 dB bandwidth of 3 GHz or more, is able to provide safety features that ordinary vehicular radars cannot provide. Because of the safety-related uses, the automotive industry requires that such devices be able to measure the distance to an object that is 20 meters away with an accuracy or resolution of 5 centimeters.

Definition of Ultra-wideband Device

M/A-COM supports the Commission's proposal to define UWB devices as any device where the fractional bandwidth is greater than 0.25 or, above 6 GHz, occupies 1.5 GHz or more of spectrum. Notice, para. 21.

However, by defining the occupied bandwidth as the 10 dB bandwidth rather than the 20 dB bandwidth, some devices might be unnecessarily excluded. We believe that if the 20 dB bandwidth can be measured, that it should be used for determining whether a device qualifies as ultra-wideband

Peak-to-Average Ratios

M/A-COM supports the proposal (Notice, para. 43) to apply a peak-to-average ratio limit that varies depending on the bandwidth of the emission. This has the effect of using a power density rather than an absolute power limit, a result that we supported earlier in this proceeding. See Reply Comments of M/A-COM at page 6, January 4, 1999.

As we understand the proposal, for a UWB device operating above 6 GHz having a bandwidth of at least 1500 MHz, applying the formula in paragraph 43 to a bandwidth of 1500 MHz would result in a maximum peak-to-average ratio of 49.5 dB. We support this approach. However, we propose that if it is possible to measure a 20 dB bandwidth, then that bandwidth should be used in the formula.

This approach would permit the deployment of low duty cycle products that are very unlikely to create harmful interference yet will bring substantial public interest benefits. Moreover, because of the time averaging over a duty cycle, it gives a manufacturer the flexibility to trade off peak power levels vs. duty cycle, a flexibility that was heavily constrained by the current 20 dB peak-to-average limit. For example, the M/A-COM High Resolution 24 GHz automotive radar has a 10 dB bandwidth of 1500 MHz, an

average duty cycle of 0.175 percent, and emits pulses of 350 picoseconds. With the 0.175 per cent duty cycle a peak-to-average ratio of 27 dB is possible, substantially greater than the existing limit of 20 dB. (Under the proposed new bandwidth-dependent formula, we note that a 1500 MHz bandwidth might permit a peak-to-average ratio as high as 49.5 dB, but instead we have chosen a design that emits pulses more frequently.)

The 500 microvolt per meter limit of Section 15.209 translates into an EIRP of 0.075 microwatts per MHz, or 112.5 microwatts in 1500 MHz. This average EIRP, coupled with the duty cycle of 0.175 percent, would allow this device to employ peaks of up to 64 milliwatts (18 dBm). We note, however, that with a different design that employed a lower duty cycle as low as –49 dB, or equivalently a peak-to-average ratio of 49 dB, a peak power of up to about 10 watts would be permissible. It is this flexibility to trade off duty cycle against peak power levels that has been overly constrained under existing rules.

With the 27 dB peak-to-average ratio, our automotive radar device can meet the automotive industry needs to measure distances with a resolution or precision of 5 centimeters over a range of 20 meters. In contrast, the existing limit of a 20 dB peak-to-average ratio would require a faster pulse repetition frequency, but that would impose a requirement for more complex signal processing that would reduce reliability. In summary, our analysis shows that an automotive radar device meeting the proposed peak-to-average limits would be able to achieve an adequate level of precision over an adequate range to satisfy the industry needs.

Measurement Methods

The Commission's proposal to use direct time domain measurements of signal peaks is not helpful for 24 GHz devices, because no equipment exists to make such measurements.

Our UWB device, for example, emits pulses that exhibit envelope fluctuations, but it is not possible to track the fluctuations over the 350 picosecond pulse by direct measurement at 24 GHz.

M/A-COM is exploring the feasibility of several measurement methods, including phase coherently downconverting the pulses without substantially disturbing the envelope. We would expect to describe our measurement methods fully at or before the time the equipment authorization materials were submitted.

Conclusion

In light of the these considerations, the Commission should adopt the proposed definition of ultra-wideband, modified to allow use of a 20 dB bandwidth if it is measurable. The Commission should adopt the proposed peak-to-average specification. And the Commission should permit manufacturers to develop alternative measurement methods and describe them at the time their devices are submitted for equipment authorization.

Respectfully submitted,

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